"Combined gear change and brake control unit for a bicycle"

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DESCRIPTION

This invention relates to a combined gear change and brake control unit for a bicycle. More precisely, this invention relates to a combined unit of the type described by the Applicant in document EP 0 504 118. This document describes a combined control unit comprising a support body connected to a brake control lever pivoting around a first axis and a gear change control unit connected to the support body. The gear change control unit comprises a shaft turnable around a second axis orthogonal to said first axis and carrying a pulley on which the end portion of a control cable of a front or rear derailleur of a bicycle is wound. The rotation of the shaft in a first direction can be controlled by means of a gear change lever, which is arranged immediately behind the brake control lever, while the rotation of the shaft in a second direction can be controlled by means of a button lever, operating on a gear, which is solidly fastened to the shaft. As concerns the shaft control in said second direction, the control unit of the known kind consists of a spring retainer mechanism to withhold the shaft in a number of reference positions. The button lever is destined to co-operate with the gear solidly fastened to the shaft by means of a meshing unit, to produce the rotation of the shaft from one of said reference positions to another.

The objective of this invention is to provide a gear change control unit which is constructively more simple and cost-effective than the one described above. An additional objective of this invention is to provide a gear change control unit requiring a very limited

stroke of the button lever to shift the gear.

According to this invention, these objectives are attained by means of a combined control unit which characteristics are described in the main claim.

This invention will be better explained by the following detailed descriptions with reference to the accompanying figure as non-limiting example, whereas:

figure 1 is a lateral partially sectioned view of a combined control unit according to this invention,

figures 2a, 3a and 4a are sections according to the line II-II in figure 1 illustrating the operation of a unit during gear change in a first direction,

figures 2b, 3b, 4b are similar sections to those shown in figures 2a, 3a and 4a illustrating the operation of the unit during the gear change in a second direction,

figure 5 is a section according to the line V-V in figure 2a,

figure 6 is a lateral partially sectioned view of a second form of embodiment of the unit according to this invention,

figure 7 is a similar view to figure 6 illustrating a second operative position,

figure 8 is a perspective view of the part indicated by arrow VIII in figure 6, and

figure 9 is a plan view according to the arrow IX in figure 8.

With reference to figure 1, numeral 10 indicates a combined gear change and brake control unit of a competition bicycle. Unit 10 essentially works as the unit described in the previous patent application EP 0 504 118 by the Applicant to which reference is made for all aspects not expressly illustrated in this description.

The integrated control unit 10 comprises a support

body 12 with means (not illustrated) for fastening to the handlebar of a bicycle (also not illustrated). A brake control lever 14 is pivotally fastened to the support body 12 around a first axis formed by a pivot 16. In the known way, an end of a brake control cable is anchored to an upper end of the lever 14.

The support body 12 carries a gear change control unit, generally referred to with numeral 18, comprising a shaft 20 turningly connected to the support body 12 around a second axis, either orthogonal, or essentially orthogonal, to the pivoting axis 16 of the brake control lever 14. The shaft 20 carries a pulley 24 on which an end portion of a control cable of a front or rear derailleur of a bicycle is wound. The rotation of the shaft 20 in a first direction, indicated by arrow 26 in figures 2a, 3a and 4a additionally winds the derailleur control cable on the pulley 24, while a rotation of the shaft 20 in a second direction, indicated by the arrows 28 in the figures 2b, 3b and 4b, releases the control cable of the derailleur.

For correct understanding of this invention, it is important to observe that the shaft 20 is constantly subjected to torque, which tends to turn it in the release direction of the derailleur control cable (in the direction indicated by the arrows 28). In the form of embodiment illustrated in the drawings, the torque which tends to turn the shaft 20 in the release direction of the cable is produced by the derailleur control cable, which is subjected to the action of an elastic element arranged in the derailleur.

With reference to figure 1, the gear change unit 18 comprises a gear change lever 30 arranged immediately behind the control lever of the brake 14. The gear change lever 30 is associated to a mechanism for controlling the rotation of the shaft 20 in said

first direction 26. This mechanism can be made as described in detail in document EP 0 540 118, or alternatively as described in a contemporaneous patent application by the same Applicant with the same title.

With reference to the figures from 2 to 5, the unit 10 comprises a button lever 32, associated to a mechanism for controlling the rotation of a shaft 20 in said second direction 28. With reference to figures from 2 to 5, the button lever 32 is arranged on a side of the support body and is pivotally mounted on the support body by means of a pivot 34, which axis is either parallel, or substantially parallel, to the rotation axis 22 of the shaft 20. The gear 36 is solidly fastened to the shaft 20. The gear 36 is equipped with a first set of teeth 38 and a second set of teeth 40. The gear change control unit 18 comprises a rocker arm 42 pivoting on the support body 12 by means of pivot 44. The rocker arm 42 comprises a first meshing unit 46, which meshes the teeth of the first set, and a second meshing unit 48, which meshes the teeth of the second set. The rocker arm 42 is made so that when the first meshing unit 46 meshes the teeth 38, the second meshing unit 48 is released from the teeth 40 and, conversely, when the second meshing unit 48 engages the teeth 40, the first meshing unit 46 is released from the teeth 38.

The rocker arm 42 has an appendix 50, which co-operates by resting on a corresponding appendix 52 of the button lever 32, so that an anticlockwise oscillation of the lever 32 around the pivot 34 generates a clockwise oscillation of the rocker arm 42 around the pivot 44. The rocker arm 42 and the button lever 32 co-operate with the respective elastic elements 54, 56, consisting of, for example, small compressed coil springs, arranged between the support

body 12 and the respective housings formed in the rocker arm 42 and in the button lever 32. The spring 54 associated with the rocker arm 42 will tend to make the rocker arm 42 turn anticlockwise and, consequently, tend to keep the rocker arm 42 in a position in which the first meshing unit 46 meshes the teeth 38. The spring 56 associated with the button lever 32 tends to turn the button lever 32 in the clockwise direction, that is in the direction corresponding to a respective distancing between the appendixes 52 and 50. The spring 56 pushes the button lever 36 towards an end of stroke stop defined by a part of the support body 12.

The teeth 38 and the corresponding meshing unit 46 are shaped so that when the first meshing unit 46 meshes the teeth 38 of the first set (figures 2a and 2b), the gear 36 (and, consequently, the shaft 20) is free to turn in the direction shown by the arrow 26 in figure 2 (direction of most winding of the derailleur control cable on the pulley 24), while the meshing unit 46 prevents the rotation of the gear 36 in the opposite direction (release direction of the cable), indicated by the arrows 28 in the figures 3b and 4b. When the second meshing unit 48 engages the teeth 40 of the second set (figure 3b) it prevents the rotation of the gear 36 in the direction indicated by the arrows 28 (release direction of the cable).

In the form of embodiment illustrated in the figures from 1 to 5, the teeth 38, 40 have saw-tooth profiles, which together form ratchet mechanisms with the corresponding meshing units 46, 48, engaging in the direction 28 of cable release.

In home conditions, the unit is in the configuration shown in figure 2a. In this configuration, the derailleur control cable applies a torque to the shaft 20, which tends to turn it

anticlockwise. The ratchet mechanism formed by the first meshing unit 46 and the teeth 38 prevents the rotation of the gear 36 and the shaft 20 in the anticlockwise direction. The sequence shown in figures 2a, 3a and 4a illustrates the condition in which a single gear is shifted in the direction of most winding of the derailleur control cable on the pulley 24. The gear is shifted by oscillating the gear change lever indicated with numeral 30 in figure 1. This oscillation of the lever controls the clockwise rotation of the shaft 20 with reference to figures 2a, 3a and 4a. The ratchet mechanism formed by the first meshing unit 46 and the teeth 38 of the first set does not obstruct the clockwise rotation of the shaft 30. This ratchet mechanism forms an indexing unit which signals the passage from one gear to the following gear by clicking. The user clearly hears when the mechanism shifts, because the first meshing unit 46 clips onto a subsequent tooth 38.

The operative sequence shown in figures 2b, 3b and 4b illustrates the condition in which the gear is shifted by operating the button lever 32. The configuration in figure 2b shows a home position, which is identical to the position of figure 4a. Starting from the configuration in figure 2b, the user presses the button lever 32 downwards and controls the oscillation around the pivot 44 of the rocker arm 42. As soon as the first meshing unit 46 is released from the tooth 30, the gear 36 is simultaneously free to turn under the action of the return torque generated by the derailleur control cable. The gear 36 consequently oscillates in the direction indicated by the arrow 28 until one of the teeth 40 meets the second meshing unit 48 (figure 3b). At this point, the shaft 20 has made a turn, which amplitude is equal to half the rotation

needed to shift the gear. When the user releases the button lever 32, the rocker arm 42 oscillates anticlockwise to return to home conditions. By effect of this oscillation, the second meshing unit 48 is released from the tooth, simultaneously releasing the gear 36, which is free to turn anticlockwise under the action of the return torque generated by the derailleur control cable. The oscillation of the gear 36 ends when one of the teeth engages a first meshing unit 46 (figure 4b). Consequently, a gear shift control in the release direction of the derailleur control cable requires a downwards thrust of the button lever 32 and a release for the same lever which returns to home position under the return action of the elastic means 56. A first half of the angular oscillation stroke of the shaft needed to shift the gear is made by effect of the downwards thrust of the button lever and the subsequent half of the angular stroke of the shaft is obtained by releasing the button lever.

This description shows that the amplitude of the angular stroke of the button lever 32 is independent with respect to the amplitude of the angular stroke of the shaft required to shift the gear. Advantageously, the button lever 32 can provide a very small angular stroke, so that the user can operate the lever with a light pressure of the thumb, without needing to make a long control stroke with the thumb. Figures from 6 to 9 illustrate an alternative form of embodiment of the mechanism described above. The parts corresponding to those described above are indicated with the same numeric references.

With respect to the form of embodiment described above, the variant in figures from 6 to 9, the gear 36 is equipped with front teeth, instead of radial teeth. The frontal teeth of the gear 36 are indicated with

numerals 38 and 40. The rocker arm 42 is ring-shaped and equipped with a pair of diagonally opposite appendixes 58, 60 (figures 8 and 9), which define an orthogonal rotation axis with respect to the shaft 20. The appendix 60 has a control arm 62 on which a portion of the button lever 32 (figures 6 and 7) operates to control the oscillation of the rocker arm 42. As shown in figures 6 and 7, the spring 54 which holds the rocker arm 42 in home position acts along a direction of the axis 22 of the shaft 20. The same spring 54 also holds the button lever 32 in home position. Figure 6 illustrates the home position of the mechanism, while the figure 7 illustrates the position assumed by the mechanism following a downwards push of the button lever 32. Similarly to the form of embodiment described above, the rocker arm 42 has a first and a second meshing unit 46, 48 for meshing the respective teeth 38, 40. The meshing units 46, 48 are formed so to allow the free rotation of the gear in one direction and to prevent rotation in the opposite direction, as described above. The operation of the mechanism illustrated in figures from 6 to 9 is substantially identical to that of the unit described above, with the only difference that the ratchet mechanism consists of teeth and meshing units which mesh frontally, instead of radially.